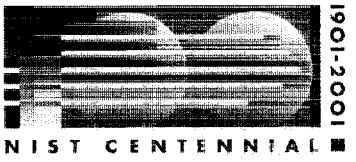
NISTIR 6588

FIFTEENTH MEETING OF THE UJNR PANEL ON FIRE RESEARCH AND SAFETY MARCH 1-7, 2000

VOLUME 1

Sheilda L. Bryner, Editor



National Institute of Standards and Technology
Technology Administration, U.S. Department of Commerce

NISTIR 6588

FIFTEENTH MEETING OF THE UJNR PANEL ON FIRE RESEARCH AND SAFETY MARCH 1-7, 2000

VOLUME 1

Sheilda L. Bryner, Editor

November 2000

U. S. Department of Commerce
Norman Y. Mineta, Secretary
Technology Administration
Dr. Cheryl L. Shavers, Under Secretary of Commerce for Technology
National Institute of Standards and Technology
Raymond G. Kammer, Director

APPROACH TO EFFICIENT SYSTEM OF BUILDING CONTROL

Naohiro Takeichi
Associated researcher, Building Research Institute,
Tsukuba, Japan

ABSTRACT

In the industrialized countries, the authorities have been preparing revisions of building control systems including performance-based code for the global market, encouragement of technical innovation, etc. The purpose of this paper is to apply the economic theory, including market failure and government failure, to the construction market to discuss more efficient approaches to secure the performance of buildings and their components.

INTRODUCTION

There are many kinds of regulations to keep public safe and healthy. Regulations have been established when some serious accidents occurred, or when some individuals or organizations alerted the hazards to become serious social problems. The public sectors of national and local government and parliament have established and reinforced the regulations each time when serious damages have made to the society. But the some economist and industries criticize that overdoing to regulate makes economic stagnation.

Primitively the Japanese constitution guarantees the maximum freedom of individual activities, but it also permits governments or other public authorities to have some regulations from the public welfare stand point. So buildings and dwelling houses have to be regulated to protect public health and safety although individual activities are limited. However there are some issues to be discussed whether the regulations applied reasonably. Also, the balance between public welfare and individual rights must be discussed.

In recent Japan, the economic depression still suffers the market. Government gets a power to refine and deregulate the overdoing regulations to revitalize industrial and individual activities. In the construction industry, the Building Standard Law is going to amend to introduce performance based code and inspections by private company. And also they instituted a dwelling performance indication system requiring builders and contractors 10-year guarantee on weather tightness and structure.

This paper will discuss several social systems based on recent market approaches as describes in previous paragraphs. The construction market, negative effects and their reasons will be discussed from the points of imperfect information and the externalities.

NEGATIVE EFFECTS PRODUCED BY IMPERFECT MARKET

In many countries, including United States and Japan, most buildings and houses are built and dealt through the market. In economics, if the market condition functions properly, money, time, natural resources and other resources will efficiently used to satisfy the consumers' convenience. This means, consumers can satisfy their demand in low price, and suppliers will be able to earn maximum amount of money through the market with most efficient consumption of resources. In other words, efficient market means anyone cannot be made better off without making someone else worse off the allocation of resources. (No one cannot satisfy their demands without forcing others to sacrifice.) But unfortunately in the case of construction market, if there is no regulations or alternative actions, market cannot be efficient. And the case will be called "market failure".

As a client would like to satisfy his demands to build a building, the supplier doesn't positively meet client's claims except the part that the client can see and confirm. The other part, ones that the client cannot confirm in the real building or any plans at the contract, or ones that are required by the people, who are affected by the construction except the owner, are left unfinished. If their demands will not satisfied, there are sometimes negative effects to the final outcome. In the worst case, they must become social problems.

IMPERFECT INFORMATION

Generally it is known, that suppliers have much information about its products than consumers. This can also be applied to buildings. About a trade of a building or a house, a consumer cannot find out the performance differences of each component easily. For example, a consumer can not confirm its weather tightness, or earthquake resistant of the building that they would like to purchase.

And even for a small dwelling house is much expensive, consumers have few opportunities to buy them. Because of the consumers' little experience to purchase houses, it is difficult to make out good/bad about produts, dealers, and builders.

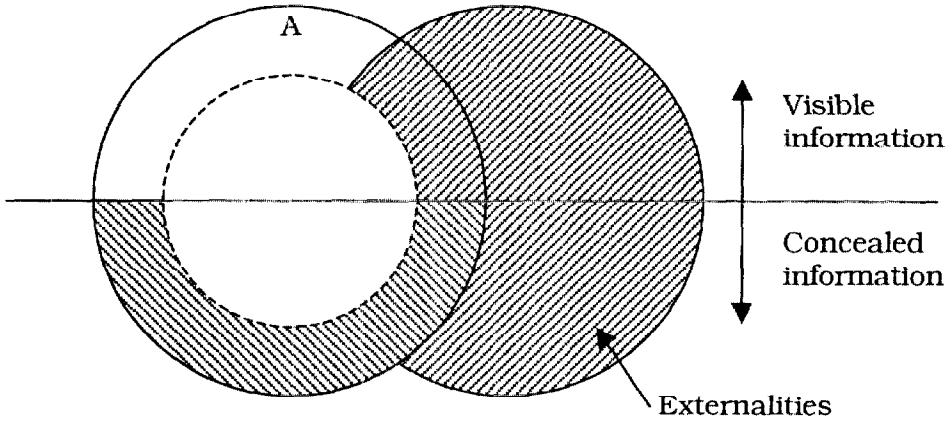
On the other hand, main aim of suppliers is pursuit of profits. To increase profits, they sell buildings in higher prices and larger quantities with additional value, if they cannot, then they cut down the price. In the case suppliers would cut down the price, they lower the performance of some components that the client doesn't require or can't confirm.

If suppliers want to gain profit in short range of time, they may downgrade the performance, which is not disclosed by the purchaser at the time of the contract. However these efforts of the suppliers will be found in several years after the purchase of the product, or when an occasional disaster strikes. If the downgraded building performance include indispensable functions such as stability of foundation, fire resistance etc., safety and health of the human living inside will be put in to serious danger.

NEGATIVE EXTERNALITY

There are variety of types and scales of buildings, including a house used by only a family or

Figure 1. Structure of the demands about he building performance



A. Demands that the client want
B. Demands that the neighborhood want
C. Achieved performances

The hatched: Demands that may affect badly though suppliers are passive to satisfy

huge complex used by thousands of people. Except for the building that stands alone and far from central city, building accommodates some influences not only to their owners and users but also to their neighborhoods. In economic the case is called a market failure with externalities. The externality is what a building has affected to the people, who is not related to contracts of the building, or products or service that are produce in the building, and who gets nothing against its effects.

The externalities include negative effects and positive ones. Examples of negative externalities are, injured of pedestrian caused by a collapsing of wall, and death of audience or injuries caused by fire in a theater.

Thoughts to reduce negative externalities are necessary, however it requires costs. The costs will be added to the sales prices of the goods finally, but both consumers and suppliers usually don't except additional price increase. The reductions of externalities are passive on the economic activities in the market. But if negative effects by externalities are not corrected, they often cause social problems.

REGULATION BY GOVERNMENT

On each contract in the market, suppliers act very positively to satisfy only the clear part of clients' demands, but they tend to be negative to the ones that cannot be confirmed easily, and ones by neighborhoods. But in the case that the demands are essential for public and owners, such as ones related their health and safety, some response for the market failure must need.

On the real society, there are already many responses for the market failure. And the public sector including government has a big role. National and local governments provide legal framework that describes essentials for buildings, they collect information by checking plans and inspections, and directly execute amendment or demolition of illegal buildings.

In the inspections, against the component of a building that cannot be decreased during the entire life cycle of the building, inspections have to be done before it is covered in a wall or under a floor. On the other hand, inspections against the equipment, which has to be maintained regularly, such as fire detector or sprinkler, inspections should be done every time when the equipment's reliability is no longer functional.

GOVERNMENT FAILURE

Government often intervenes against the market failure. However even government cannot avoid failures in many cases that cannot get good results people want.
One reason of government failure, which is "the imperfect information" also, makes a problem for public sector as well as private sector. Even government cannot get information of building performance perfectly. Many indispensable performances of building parts like structures including basement, columns, beams and their joints are concealed. And those are too many members to inspect economically. And there is another point in the real society. Not so few men are willing to cheat inspectors and making negative impacts for consumers and citizens. In Japan, because of negligence of builders the defective components of dwelling houses have become a major problem among society.

Also in recent Japan, there is a criticism of the efficiency of government and less flexible application of regulation on the points of demands and procedures. On legal framework, citizens who have suffrages should control government, but it is difficult to assess the efficiency and achievement of goals of the policy.

And in the real construction industry, it is important that a *building and their components satisfy regulations.* So many suppliers have no incentives to provide better (or bad) performance products than required on regulations. This means that in the market there are same products in same levels that are not related to consumers' interests. This quality level won't change even if public needs are changed, unless the regulations are amended. However, revisions of regulations or to replace them with new regulations require long terms and huge efforts. Therefore regulations tend to be stable.

ALTERNATIVE APPROACHES

Some alternative approaches to government failures are devised. Performance based code

system and inspections by private sectors, are expected to add flexibility to the procedures to regulate. These new system will be introduced into the new revision of the Building Standard Law.

Performance based code system is expected to encourage material makers in development of new materials, and designers in new structures or dramatic interiors that cannot be built or forced extra efforts to fit to the current conservative prescriptive regulations. Also the inspection by private sectors will introduce competitive theory to the conventional inspection procedures, and it is expected to improve total inspection procedure, including the reduction of the inspection term.

Alternative approaches instead of government intervention have been also discussed. Performance indication system will start soon in Japan. In this system, suppliers show the various performances of buildings which has been concealed from the consumers, and consumers are able to judge which performance are adequate or not from the disclosure sheets. Therefore, consumers are able to make a best choice which fits their needs. As consumers can judge the performances of the buildings, which were not visible before, it is an incentive for competitors to archive better performance. It is an attempt to improve the imperfect information that used to cause the market failure.

To handle this system properly, the judgement of the performances of constructions and parts sometimes requires specific knowledge. On the consumers' side, they should have the knowledge or deputize specialists, to do lead their way to good results. On the public side, it is necessary to provide the regulations with clear and easy expressions to make easily understandable for public.

And others - insurance, obligations of performance guarantee in terms and categories are worthy to consider.

SOLUTIONS

Historically, to maintain public health and safety, government has made regulations. But economists and industries have criticized their efficiency, and they have required deregulation or removals of the overdoing regulations. However we have to carefully consider the case that there are externalities that can't be corrected due to little incentives to participants in the market, and also the case that it is difficult to break up the imperfect information. If problems of private incentives and imperfect information cannot be solved, construction market will not revitalized even though the government deregulates the regulations.

In the construction society, the discussion regarding worth, efficiency, and methods of regulations just start. However such as EU, the construction market is rapidly unified to a global market. Designers, constructors, materials, construction methods etc can easily jump the border. To secure the public health, and to archive efficient systems, it is necessary to study and discuss more widely and deeply.

REFERENCES

1. Naohiro Takeichi, "Building Regulation and Market," Journal of Japan Association for Fire Science and Engineering, Vol.49, No.6 November/December 1999

2. Joseph E. Stiglitz, "Economics / Joseph Stiglitz - 2nd edition," W. W. Norton & Company, Inc., 1996

3. Naohiro Takeichi and Makoto Tsujimoto, "Security of building performance by inspection in Westminster, France, Los Angeles: Research in Systems of building control Part 1," Journal of Architecture, Planning and Environmental Engineering, NO.521 , p.167 , Jul. 1999

4. Kouhei Matsumoto, "Study on Base of Building Control by Market Theory: On Deregulation of Building Control (Part1)," Research Papers on City Planning in 1999, The City Planning Institute of Japan